Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Journal of the Society of Arts.

FRIDAY, JANUARY 31, 1862.

◆

MEMORIAL TO HIS LATE ROYAL HIGHNESS THE PRINCE CONSORT.

The Council hereby convene a General Meeting of the Members of this Society, to be held on Friday, the 7th of February, 1862, at 4 o'clock p.m., for the purpose of receiving a Report from the Council on the vote of One Thousand Guineas to the Fund now being raised for a National Memorial to his late Royal Highness the Prince Consort, President of this Society.

By order of the Council,
P. LE NEVE FOSTER, Secretary.
Jan. 30th, 1862.

COMMUNICATION BETWEEN THE DISTRICTS NORTH AND SOUTH OF HYDE-PARK.

The Council, bearing in mind the important influence which such a communication could not fail to have upon the success of the Exhibition of 1862, have appointed a committee to promote this object.

This committee is now engaged in considering various proposals which have been laid before them, and will shortly make their report.

INTERNATIONAL EXHIBITION OF 1862.

The Council beg to announce that the Guarantee Deed is now lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate to £444,700, have been attached to the Deed.

Guarantors holding ivory tickets for visiting the building are informed that those tickets are not available for any Saturday after the 1st of February.

WEEKLY PROGRESS OF THE INTERNATIONAL EXHIBITION.

It is satisfactory to be able to record a termination of the difficulty of colouring the inside of the building. After experiments submitted by Mr. Hudson, Mr. Kelk, Capt. Fowke, and Mr. Crace, it has been finally decided that the matter shall be placed in the hands of the last-named gentleman. He proposes to colour the pillars of the nave alternately a dark olive and red chocolate, with gilded capitals, and a line of gold round the base. The rib will have a narrow edging of light grey, and behind that panels alternately of scarlet and blue, picked out with gold; while the roof is a warm grey, with a foliage ornament in gold. The panels are so arranged that if in one rib the order of the panels is scarlet, blue, scarlet, in the next it is blue, scarlet, blue; thus preventing a long line of one colour running all down the nave. The great advantage obtained by this treatment is the lightness given to the roof. The rib, being of wood, looked heavy enough to crush the iron column on which it rested, but by means of the light edge outside the richer colours, this heavy look is completely dissipated. It may, perhaps, be objected that the treatment is not constructive; the details of the fitting of the rib are not distinguished by colour, while a series of false panels is created.

The domes are being pushed forward as rapidly as possible, and the western, although delayed by want of material, is now close on the heels of the eastern. The terminals are in course of construction below, and will be hoisted bodily to the summits of the domes. They will consist of a gilt ball and spike, the ball being seven feet in diameter. The walls of the picture galseries are being papered, and will very shortly be ready for the reception of pictures.

In the western annexe foundations are being laid on which heavy machinery will rest. The eastern annexe is advancing rapidly. In this latter will be exhibited minerals, chemicals, food, animal and vegetable products, and agricultural machinery; a space is also reserved at the end for a Third Class Refreshment Court.

Switzerland.

The following gentlemen have been appointed to represent the interests of the Exhibitors from Switzerland:—

Mr. John Rapp, of Bâle, agent and Consul-General for the Confederation, *President;* Albert Streckersen, *Vice-President;* Mr. J. C. Imthurm, of Schaffhause; Mr. Paul Bröe, of Geneva; Mr. G. Prevost, of Geneva; Mr. L. R. Bodmer, of Zurich; Mr. John Spitzle, of St. Gall; and Mr. Philippe Walther, of Vevey. Commissioners:—(Industrial Department) Mr. Gustave Vogt, Berne; (Fine Arts) Mr. François Buchser, Manchester.

Brazil.

The following gentlemen have been appointed Commissioners for Brazil:—The Commandeur Francisco Ignacio de Carvalho Moriera, Brazilian Minister, *President;* the Baron de Mana, and the Commandeur Joao Manoel Periera da Silva.

Agent in London—Wm. Henry Clark, Esq., No. 6, Leinster-terrace, Hyde-park, W.

SEVENTH ORDINARY MEETING.

Wednesday, Jan. 29th, 1862.

The Seventh Ordinary Meeting of the One Hundred and Eighth Session was held on Wednesday, the 29th inst., John Hawkshaw, Esq., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Bridson, T. Ridgway.....	Bridge-house, Bolton.
Challon, Charles	3, Berners-st., Oxford-st., W.
Clark, George	Albion-chambers, Bristol.
Dunning, Joseph	Langley, near Haydon-bridge, Northumberland.
Francis, David	24, Mile-end-road, E.
Foxwell, Thomas S.......	Shepton Mallet.
Howes, John	45, Hamilton-ter., St. John's-wood, N.W.
Smith, Henry..............	Bankfield, near Ulverston.
Thomson, John Robert...	19, Cadogan-place, Lowndes-square, S.W.
Wyon, Joseph Shepherd.	287, Regent-street, W., and 3, Langham-chambers, W

The following candidates were balloted for and duly elected members of the Society:—

Atkins, George James ...	25, Ovington-square, Brompton, S.W.
Barclay, Robert	29, Bucklersbury, E.C.
Beacock, Robert	Beeston-hill, Leeds.
Bingham, Henry C.	Wartnaby Hall, near Melton Mowbray, Leicestershire.
Binnie, Alex. Richardson.	7, Upper Lansdowne-terrace, Notting-hill, W.
Brooke, Edward...........	Norton Lodge, Timperley, Cheshire.
Brown, George	25, Newman-st., Oxford-st., W.
Chappell, James............	388, Strand, W.C.
Cranston, James............	Birmingham.
Dalley, John Lambert ...	Woodbury, Addiscombe.
Dawson, Christopher Holdsworth..............	Weston Hall, near Otley, Yorkshire.
Draper, John	Reform Club, S.W., and 9, Lonsdale-terrace, Barnes, S.W.
Fearon, Frederick	13, Pall-mall, S.W.
Fisher, Richard	Hill Top, Midhurst.
Gath, John William......	Bradford, Yorkshire.
Heintzmann, Alexis	9, Friday-street, E.C.
Huguenin, Gustave	50, Greek-street, Soho, W.
Jackson, Frederick Rowland........................	Maple-villa, West Dulwich, S.
Kirk, John..................	Beech-hill, Armagh, Ireland.
Leavers, J. W.	The Park, Nottingham.
Madden, James............	3, Leadenhall-street, E.C.
Masey, Thomas Adair ...	3, Bernard-street, Primrose-hill, N.W.
Mason, Rev. George	Copthewick, near Ripon.
Mason, Wm. Henry	Kingsland Basin, N.E.
Moss, Arthur	22, Kensington-pk.-gdns., W.
Nichols, William	Green Mount-terrace, Leeds.
Ogilvie, Robert Annesley.	24, Mecklenburgh-sq., W.C.
Piggot, Joseph A.	Bedford.
Purdie, Thomas............	314. Oxford-street, W.
Ransome, Joseph Atkinson	St. Peter's-square, Manchester.
Remington, Reginald (Messrs. Crawford & Co.)	71, Old Broad-street, E.C.
Sandell, Richard Barker...	Osborne Lodge, Tulse-hill, S., and 45, Upper Thames-street, E.C.
Schröder, Anthony.........	26, Clifton-gardens, Maida-vale, W.
Squire, Francis	Downend Lodge, Lostwithiel, Cornwall.
Turner, John Pemberton.	Snow-hill, Birmingham.
Walker, Henry	47, Gresham-street, E.C.
Weston, John D.	West-park, Bristol.
Wilson, James	Ravensbourne-park, Lewisham, S.E.
Woodward, Horace	Atlas Works, Great Charles-street, Birmingham.

The Secretary called attention to some specimens of a Miners' Safety Lamp, exhibited by Messrs. John Abbot and Co., Gateshead-on-Tyne. For description see page 164.

The Paper read was—

ON SOME RECENTLY-EXECUTED DEEP WELLS AND BORINGS.

By George R. Burnell, C.E., F.G.S., F.S.A.

The remarkable success of the operations carried on at Passy, for the supply of the artificial waters of the Bois de Boulogne by means of an artesian boring of unusually large diameter, has lately revived the public interest in that class of operations, both on the Continent and in England. It has been proposed, indeed, to apply that system, on even a larger scale than was tried at Paris, to our own metropolis; and the scheme for sinking a series of deep wells in the various parts of London has been revived by some enthusiastic admirers of the results obtained by our neighbours. Experience has already decided the problem of the possible success of such attempts here, and it may, therefore, be desirable at the present day, to review briefly the history of artesian wells at home and abroad, in order to prevent the waste of money and the disappointment which may arise from ill-advised imitation of the measures proved to be successful in some cases, but by no means universally applicable.

The term "artesian well" means, strictly speaking, only a well sunk to a considerable depth, through a dry and impermeable upper stratum, to a lower stratum charged with water, under such conditions of pressure as to cause the water to flow over the surface of the ground. The first wells of this description mentioned in modern works on hydraulics were executed in the province of the Artois, in France, where they were sunk in the chalk formation, and were supplied by the streams running between the fissures of that deposit, which were fed by the infiltration from the higher ground of the great north-eastern chalk plateau of France. It is said that some of these wells in the Artois have been used for nearly a thousand years, without any perceptible diminution in their supply; but it must also be added, that the ancient Egyptians and the Chinese had, from the remotest antiquity, been acquainted with this method of obtaining water, and that the inhabitants of the plains of Lombardy have long used the waters rising from the deep-seated strata of the valley of the Po, for the irrigation of their "marcite," or winter meadows. Be this as it may, and without dwelling upon the locality where this description of well was first made, it seems that about the beginning of the present century great attention was drawn to them by the success of a number of borings, through the London clay into the sands of the basement beds of that formation, made in the valleys of the Lea, near Broxbourne, Waltham, and Tottenham, and of the Wandle, near Mitcham, Garratt, Wandsworth, &c. In the low-lying alluvial islands at the mouth of the Thames, some very deep wells were also sunk through the London clay, and a copious supply of fresh soft water was obtained; and, in fact, so many wells have been sunk into the water-bearing strata of the tertiary sands, that they have been nearly exhausted. Whilst these operations were being carried on in England, the French engineers had energetically adopted the system upon which they were founded, and numerous artesian wells had been sunk at Epinay, Stans, and St. Denis, with similar results to those obtained near and in London, that is to say, that in the earlier wells the water, generally speaking, overflowed the surface, whilst in the later ones it rarely attained the level of the ground; and the water-line sank in the older wells in proportion as new ones were opened.

In 1833 M. Arago induced the Conseil Municipal of Paris to undertake the execution of a deep boring, in the hopes of obtaining a supply of water from the lower green sand formations, which he supposed to form a continuous bed under the chalk basin, underlying, in its turn, the tertiary strata of the neighbourhood of Paris. This lower green sand, in fact, outcrops from under the chalk on the whole of an irregular oval, passing from the north-east through the south, nearly to the north-west of Paris, and it approaches that city the most nearly at the point where the Seine forces its way through the overlying recent formations near Troyes, in Champagne. At Lusigny, the precise point of outcrop, the surface of the green sand is about 300 or 350 feet above the level of the plain of Grenelle, where it had been resolved to make the first attempt to traverse the tertiaries and the chalk. From this fact, MM. Arago and Walferdin inferred that the water from the green sand would flow over the surface at Grenelle, and they were encouraged in that opinion by the existence of numerous artesian wells carried through the chalk into that stratum from which they expected to obtain their supply at Elbœuf and Rouen. The depth it would be necessary to sink the new well constituted the unknown conditions of their undertaking; but not only MM. Arago and Walferdin, but also M. Mulot, calculated from the first, that they would find the chalk extend to at least 1,300 or 1,400 feet from the surface. So little, however, was known of the probable cost, or of the dangers and risks of these deep borings, at the time the well of Grenelle was commenced, that the municipality of Paris only voted a sum of 18,000 francs (£720) for boring three such wells.

On the 29th of November, 1833, the works of the Grenelle well were commenced by M. Mulot, and after encountering many serious difficulties from the nature of the ground, and from the fracture of the tools made to work at so great a distance from the surface, the able and scientific men who had supported M. Mulot through evil report and bad report, were rewarded by finally obtaining a copious jet of water from the lower green sand on the 26th February, 1841. The depth then reached was 1,806 feet 9 inches, of which 1,378 feet were in the chalk; the water rose at first at the rate of 800,000 gallons per day, to the height of about 122 feet (the level of the distributing reservoir of Grenelle), and its temperature was about 82° Farenheit. When it first rose to the surface, it contained large quantities of sand, clay, and other matters in mechanical suspension, and it was nearly twelve months before the water passages of the subterranean strata were sufficiently cleared to allow the water to rise in a state fit for distribution. On several subsequent occasions also, the sand has accumulated in such quantities, in the pipes lining the bore, as to render it necessary to draw and clean them.

This boring operation had been watched very carefully by English engineers, and even during its progress similar works had been attempted in our own country. As might naturally have been expected, the success of the Grenelle well, under these circumstances, induced our countrymen to continue their work with redoubled ardour, but unfortunately they have displayed less perseverance, and it is to be feared less skill, than our neighbours; for hitherto none of the deep borings undertaken avowedly for the purpose of obtaining a supply of water from the subcretaceous beds in either the London, or the Hampshire basins, have completely succeeded. In the case of the Kentish Town well, it is true that some very extraordinary and anomalous conditions of the strata have been found to exist, which have totally deranged all the scientific calculations of the able geologists and well-borers consulted during its execution; but it has too often happened in England, that works of the kind we are now considering, have been undertaken solely on the recommendation of amateur geologists, or of "practical men," as it is the fashion to call those who are totally ignorant of recorded science; and the consequence has been that several very costly wells have been undertaken, carried on at great expense, and subsequently abandoned in despair, perhaps just at the moment when success was within grasp.

One of the earliest of the attempts made in England at sinking an artesian well to the lower green sand, was the one made, almost unintentionally, by the town of Southampton. It was commenced by a preliminary boring through the London clay to the chalk, which was reached at a depth of 480 feet from the surface; the upper strata traversed consisting of the sands, clays, and plastic mottled clays of the Hampshire tertiary series. It seems that the well-borer employed carried the boring to a depth of 50 feet beyond the surface of the chalk already mentioned, and he then reported that an ample supply of water was to be obtained from that formation. A shaft was sunk, on faith of this report, commencing with a cast-iron lining of 13 feet diameter, which it was proposed to carry to a depth of 160 feet, and then to commence boring with a hole of 30 inches diameter, diminishing gradually to 20 inches in the chalk. The cylinders used were, however, found to be too weak for the purpose they were intended to fulfil; they collapsed in places, and, in driving, they assumed a direction seriously out of the perpendicular. The contractor failed when the cylinders had been thus badly lowered to the depth of about 60 feet, and the works were then taken out of his hands, and placed in those of Mr. Docwra, one of the most able well-sinkers and waterworks contractors of our country and of our day. With great trouble he drove the shaft completely down to the chalk, finishing it with a clear external diameter of 9 feet 4 inches; part of it was lined with cast-iron plates, and part of it with brickwork in cement. The brickwork lining was carried three feet into the chalk, and below it the shaft was continued to the total depth of 562½ feet from the surface, in the solid chalk, without any lining, and with a clear diameter of about 7 feet; a boring was then commenced of 7½ inches diameter, and was carried down eventually to a total depth of 1,317 feet from the surface. The chalk formation was found here to have a thickness of 851 feet, and the works were suspended when the boring had traversed only 12 feet of the chalk marl. Now at Chichester, where Mr. Gatehouse had also sunk a deep well to the upper green sand about the same period, the thickness of the chalk marl was found to be 61 feet; the upper green sand and gault are of variable thicknesses, but the greatest depth recorded for them was that of the new well at Passy, where they were about 274 feet deep. It is, therefore, very probable, that if the Southampton well had been carried down 330 feet further, or to a total depth of 1,650 feet in round numbers, the problem as to the possibility of finding water from the lower green sand, in the Hampshire basin, might have been solved. In the well at Chichester this solution could be even more easily attained, for the boring had actually been carried about 130 feet nearer to the probable surface of the lower green sand, leaving only 200 feet still to be traversed.

It would be impossible to record all the important works undertaken of late years for obtaining water by means of artesian wells, but the circumstances connected with the history of those attempted at Calais, Kentish Town, and Harwich, are so singular, that it behoves us to dwell upon them. At Calais the well was sunk through the chalk, and the whole series of the subcretaceous strata, to a total depth of 1,047 feet from the surface, but no water was obtained from it, and the boring passed, at the depth above-named, into the transition rocks, in which it was carried for a further depth of 103 feet. At Kentish Town, the Hampstead Water Works Company endeavoured to secure an artesian supply, in order to comply with the provisions of the Metropolis Water Works Act of 1851. They had very wisely consulted Mr. Prestwich upon the geological questions involved in the preliminary inquiries, and they employed Messrs. Degoussé and Laurent, the best known and the most successful well-borers up to that period, on the Continent. Geologists and practical men alike in this instance reasoned that, because the lower green sand outcropped around the edges of the chalk basin containing the London tertiaries, in precisely the same manner that the lower green sand outcropped around the chalk basin containing the Paris tertiaries, therefore, there was every *à priori* reason to believe that the subcretaceous formations would continue under London, and furnish, as had been the case at Paris, the water for a well carried down to them. Acting upon this belief, the company commenced boring in the chalk, at the bottom of a shaft previously sunk to the depth of 539 feet from the surface. The boring was commenced with a diameter of 12 inches, reduced to ten inches in the intermediate part, and finishing with a diameter of 8 inches. The work began on the 10th of June, 1853, and was carried on with every appearance of success for a considerable time. The strata traversed were found to occur in their regular order, and of the anticipated thicknesses, until the boring had traversed the gault formation at the depth of 1,113 feet 6 inches from the surface; but when, as Mr. Prestwich said, everybody believed that " a very few more turns of the augur would tap the water-bearing sands of the lower green sand formation," it was found that the borings passed at once into a series of beds consisting of alternate layers of red sandstones, red clays, conglomerates, red sands, and rounded pebbles, which geologists are now disposed to class amongst the new red sandstone series. It is very difficult to form any decided opinion as to the real nature of a deposit which has only been explored by the boring tool, especially when the diameter of the bore was only eight inches, as at Kentish Town, and I confess that for my own part, as I said before in this room, and shall have occasion again to repeat, I am disposed to regard the beds of red clays and sandstones rather as being members of the Wealden series than of the new red sandstone. But in either case it was evident that the water-bearing strata were interrupted under London, and that there was no probability of obtaining a supply of any description from them in that district. In fact, the Hampstead Water Works Company, after the failure of this attempt, were compelled to sell their interests to the New River Company, and the well was stopped at the depth above quoted, added to the depth traversed in red sandstones and clays, or at a total depth from the surface of 1,302 feet.

About the same time that this unexpected result was obtained at Kentish Town, Mr. P. Bruff, C.E., was employed upon an attempt to obtain water for the town of Harwich, either by a deep well in the chalk, or by traversing, if necessary, the strata below the chalk. Several attempts appear to have been previously made at Harwich to obtain a supply from the chalk, but they had failed, in consequence of the infiltration of salt water into the wells sunk close to the sea shore. Mr. Lankaster Webb, of Stowmarket, a town situated upon the high lands of the valley of the Gipping, the main affluent of the Orwell, had executed a well 895 feet deep, through the drift clays and gravels over the chalk, the cretaceous formations, and the upper green sands and gault. I do not know the level of the ground at Mr. Webb's factory, but as a rough guess I should say that it was about 240 feet above the high tide level at Harwich; and I am not, therefore, surprised that the persons connected with the well at the latter town should have expected, that upon traversing the chalk they would meet with a supply of water under the true artesian conditions. It happened, however, that after the Harwich boring had passed through the drift, the tertiary strata, the chalk, the upper green sand, and the gault, to the depth of 1,025½ feet from the surface, it passed, not into the lower green sand, but into a black slaty rock, which Mr. Prestwich pronounced to be a common grey slate of the palæozoic series, whose precise position in the series could, however, hardly be defined on account of the absence of fossils. Thus, at Calais, and I believe also at Ostend, the lower green sand is wanting, and is replaced by a member of the carboniferous series; at Kentish Town the lower green sand is absent, and it is replaced perhaps by the new red sandstone beds, whilst at Harwich the lower green sand is replaced by the very earliest clay slate rocks.

Now there may be drawn, from these unexpected results of the deep borings in the tertiaries of what may be specially named the London basin, some valuable scientific and practical conclusions. These may be briefly stated as follows:—1st. That at present, geology is only so far advanced as to enable us to state, with tolerable certainty, what we shall *not* find under the surface, but by no means to justify any positive assertion as to what we *shall* find: thus, knowing that the London clay is on the surface, we may be certain that the crag will not be found beneath it, but it by no means follows that necessarily the chalk, the lower green sands, the oolites, or the usually subordinate strata, should be there. 2nd. That the first attempt to sink an artesian well through a previously untried stratum, is at all times a hazardous experiment, and that it is, therefore, one which should never be tried by those who only work with the money raised by forced taxation. It was upon the latter ground that Mr. Ranger very properly recommended the town of Southampton to stop the philosophical experiment upon which they had already incurred so large an outlay; and it is certainly wiser to leave the solution of these problems to municipalities possessed of private resources, or to private enterprise, than to expend upon them the money wrung from the ratepayers. 3rd. And possibly this may be the most important conclusion of all—it would appear to be proved by the occurrence of the earlier strata in the geological series at Calais, Kentish Town, Harwich, and if I be not mistaken, at Ostend also, that Mr. Godwin Austin's theory of an upheaval of the carboniferous series existing between its extremity on the French coast, and its reappearance in the Bristol and the South Wales coal field is correct. A full discussion of this important inquiry would be misplaced in this paper, but I cannot refrain from repeating what I myself have said before, viz., that from all which is at present known, it would be more rational to seek for coal under London, than for soft water. At the same time I would carefully guard myself against any appearance of encouraging an attempt of the former description, unless it were distinctly undertaken as a speculation, with great, nay, almost infallible, chances of loss.

The next important artesian borings executed of late years in chronological order, were those undertaken under the superintendance of the French military authorities in the Desert of Sahara, avowedly for the purpose of forming stations for the caravans trading between Algeria and Central Africa. They were executed by means of tools made by Messrs. Degoussée and Laurent, who seem also to have occasionally acted as consulting engineers, but the works were actually performed by the soldiers, or the labourers employed by the " Corps du Génie Militaire." It appears that up to the month of June, 1860, no less than 50 of these wells had been sunk in the desert, and that they pour upon its thirsty surface no less than 7,920,000 gallons of water per day. Similar works were, according to Aimé Bey, executed in the deserts of Ancient Egypt, as was before alluded to, and there are good reasons for believing that the system of artesian borings might advantageously be applied in the deserts of north-western India, and of Australia.

Some interesting artesian wells and borings have also been executed in various parts of England and of the continent, to a few of which I propose to return hereafter, but, in the meantime, I pass to the description of the great work lately completed at Passy, as being the one which has attracted the most universal attention. When the great works of the Bois de Boulogne were commenced, it was soon discovered that the pumps of Chaillot would not be able to furnish the quantity of water required for the lakes and waterfalls of the new park, and the Municipal Council of Paris, encouraged no doubt by the commercial results of the previous operation at Grenelle (which had eventually cost the sum of £14,000, and had repaid its cost several times over), resolved to execute a second boring to the lower green sand, in order to secure an independent supply. It was originally proposed to execute this well of the same dimensions as that at Grenelle, that is to say, to finish with an eight-inch bore; but before it was commenced, M. Kind, a German engineer, (who had already carried out some very important works upon a system, and by the aid of tools patented by himself,) offered to contract for the new well to finish with a bore of 2 ft. in diameter, and to deliver the water at 92 ft. above the level of the ground, at the rate of nearly 3 million gallons per day. He undertook to complete the work for the sum of £14,000 within the space of two years. After some opposition, based principally on the doubts expressed by engineers, who had been consulted on the subject, with respect to the increased delivery over that of the well of Grenelle, this offer of M. Kind's was accepted, and on the 23rd December, 1854, the vote of the Municipal Council in favour of the contract with him was passed. The work was commenced shortly afterwards, and by the 31st of May, 1857, the boring had already reached the depth of 1,732 feet from the surface, when suddenly the upper portion of the tube lining collapsed, at a distance of about 100 feet from the surface, and choked up the bore-hole. This accident delayed the completion of the work for three years, and led to the rescinding of the contract with M. Kind; but the engineers of the city of Paris were so satisfied with his zeal and ability, that they confided to him the conduct of the remaining works. A new well was sunk to a depth of 175 feet 4 inches, and the boring was then cleaned out and resumed. Much trouble was encountered in traversing the strata below the distance of 1,732 feet above quoted, and at length, at the distance of about 1,894 feet from the surface, the first water bearing stratum was met with, but the water, after several oscillations did not rise to the level of the ground. The boring was continued below this level, until, on the 24th September, 1861, at midday, at the depth of 1,923 feet 8 inches, the true artesian spring was tapped. When this spring rose to the surface, it discharged at the rate of 5,582,000 gallons per day. The yield has since then oscillated, but so long as the column had not been raised above the level of the ground, the total quantity does not seem to have fallen short of 4,465,600 gallons. The well of Grenelle, (which by the way had been falling off in its yield for some time before the completion of the Passy boring, no doubt on account of some obstruction in its ascensional tube, but which for several days before the 24th September discharged regularly 200,000 gallons per day,) fell, in about 30 hours after the Passy spring had been tapped, to a yield of about 173,000 gallons, at which rate it remained stationary, until the tube of the Passy boring was raised so as to allow the water to stand at the same height in the two wells, when the original rate of delivery of the Grenelle well was resumed, but the rate of delivery of the Passy well fell to two million gallons per day. It is intended eventually to cause the column of water of Passy to rise to a height of 1,977 feet above the bottom of the boring, or about 54 feet above the surface of the ground. The horizontal distance of the Passy well from the one at Grenelle is about 3,830 yards; and it will be observed from the section on the wall, that the water-bearing stratum is nearly 100 feet nearer the mean level of the sea at Grenelle than it is at Passy, whilst the surface of the ground is about 35 feet higher at the latter locality than it is at the former one.

Unquestionably the effect produced upon the respective sources of supply, by the alteration in the heights of the columns of water, proves that the wells of Passy and of Grenelle are fed from the same stratum; and there can be no reason, therefore, to suppose that, when the Passy spring shall have cleared its water passages there should be any difference in the qualities of the waters at the two places. M. Peligot has carefully analysed the Grenelle waters, and he found that they contained 0·000142 of saline matters, composed principally of the carbonates of lime, potash, and magnesia, associated with a compound of sulphur, and of soda of variable proportions and conditions, and with the carbonate of the protoxide of iron and silica. The salts of the sulphate of lime, or of the more permanently insoluble description are absent, and it would appear that the gases diffused through the water are of considerable volume, the carbonic acid gas being one of the most so. There is a sensible evolution of sulphuretted hydrogen from both the wells of Passy and of Grenelle, and it is worthy of remark that the same gas is given off from the water in Mr. Gatehouse's well at Chichester, though in the latter instance the smell is sufficiently strong to render the water positively repulsive. At the present day the water at Passy is still foul, on account of the matters it brings up in suspension; but, as in the case of the Grenelle well, this inconvenience will no doubt soon disappear. The temperature at which it reaches the surface is identical in the two wells, and is about 82° Fahrenheit.

It may be worth while to call attention to the mechanical means adopted by M. Kind in sinking a boring of the large diameter of 2 feet 4 inches, to the enormous depth of nearly 2,000 feet from the surface. The work was commenced by a shaft, as usually is the case, and after it had been sunk to a depth of about 50 feet, the boring commenced, and was continued with as nearly as possible the same diameter to the bottom. M. Kind employed for this purpose what may be called rods with releasing joints, very closely resembling the joints introduced by Œuyenhausen, which allowed the cutting portion of the tool to be raised a certain height, and then to be released automatically; this arrangement was adopted in order to avoid the lashing of the sides of the bore by the long rods, and to regulate the force of the blow. The cutting tool used by M. Kind also differed from the tools generally employed, for it consisted of a single or a double trepan, according to the nature of the ground, instead of the ordinary chisels and augurs. A patent was taken out for these tools by M. Kind, No. 13,478, of the year 1854, the printed specification of which contains a series of engravings of the various modifications proposed for the various kinds of rocks; in the *Annuaire Scientifique* for 1861, illustrations will also be found of the ordinary trepans and of the slide joints. M. Kind is able, by these combinations, to strike as many as twenty blows in a minute with the greatest regularity at a depth of 2,000 feet. The patent of 1854 specifies also certain methods of lining the sides of the borings; but it must be confessed that they do not seem to me to possess any great merit, and indeed M. Kind had more difficulties to encounter at Passy from the collapsing of his tubes, than from any other cause. It is a common error of well borers to undervalue the effort exerted by clays swelling when charged with water; and the great delays encountered in sinking the Passy well were precisely caused by the false economy introduced in the execution of the tube linings. The time actually employed in sinking the Passy well was nearly the same as that employed at Grenelle; in the former instance it was 6 years 275 days, in the latter it was 7 years 90 days. The cost of the Grenelle well, as above stated, was £14,000; that of the well at Passy was £40,000, but it must be observed that the quantity of water, delivered at the same height in the two cases, is ten times greater at Passy than it is at Grenelle; the rates of delivery are, in fact, nearly in the direct ratios of the diameters.

I have not been able to learn whether the artesian wells of Elbœuf and of Rouen have been affected by the completion of the new well at Passy, and at present I am inclined to believe that they may escape this action, on account of their proximity to the entering ground of the lower green sands, on the western margin of the cretaceous basin. At Tours, however, so many wells have lately been sunk (in an early edition of M. Degoussé's excellent *Guide du Sondeur*, that gentleman mentions that he himself had executed no less than sixteen of them), that the subterranean supply is becoming exhausted, and, as in the case of the wells supplied by the basement beds of the London clay, the lower green sand wells are gradually losing their artesian character. In two wells also, at Evres and Ferrières, the subcretaceous formations yielded no water; and in the latter the bore was even carried to a depth of 30 feet in the great oolitic, or jura limestone series, without obtaining a supply. I call especial attention to this fact, because it illustrates again the uncertainty at all times overshadowing the execution of the first deep wells in a particular district, and that the stratum which yields water in one locality is likely to be unable to do so in another. The enterprising gentlemen who are engaged at the Hastings well should bear this fact in mind, and though I believe that after they shall have traversed the lower members of the Wealden series, they are more than likely to find the upper or Portland oolite, which is of sufficient water bearing power to ensure them a good supply of water, they must also be prepared for disappointment. The Hastings well is already 553 feet deep, still in the Hastings beds, and as these have never yet been traversed, it is impossible to say whether they will be found to be seven or seventeen hundred feet thick. Most probably the former guess will be found to be the more correct, because the town of Hastings is situated at a low horizon in the series of Weald beds; but all operations of this description at Hastings must for the present be conducted in doubt as to the ultimate result, however strong may be the hopes of success. The character of the strata already traversed, and of those likely to be met with at Hastings, leads me to believe that M. Kind's processes would be particularly applicable there, but the success of such an operation would still be a mere matter of speculation, such as ought to be left to private enterprise.

I dwell a little on this point, because the Board of Guardians of Brighton are engaged upon a similar experiment, at a place called the Warren Farm, near that town. It is not my place to criticise the mode of execution adopted in carrying on this work, but I cannot refrain from saying that there are many things about it which seem to me to be in opposition to the opinions now entertained by scientific engineers, and I gravely suspect that, even if water from the subcretaceous formations should be obtained at this well, it cannot, by any possible chance, rise near the surface, which, at the Warren Farm, is not less than 410 feet above the mean tide level. It is inexplicable to me also, that this well should be continued by means of a shaft, at the great depth already reached, instead of by means of boring; and I regret bitterly to see an experiment, which has been carried on hitherto with so much spirit, compromised by what I consider the mistaken course latterly adopted. At Brighton, nevertheless, the only chance of securing a supply in the parts of the chalk basin lying beyond the influence of the faults or "cross throws" which have, for instance, enabled the Water Works Company to obtain, as is said, one million gallons per day, is to penetrate the chalk to the lower green sand. Notwithstanding the cost of the previous experimental borings in the surrounding countries, I am convinced that the cheapest manner of effecting this object would have been to have bored, rather than to have sunk a shaft, and even now the Guardians would do wisely to adopt this course, especially as theirs is really the first experimental shaft or boring on the east bank of the Arun. It is, however, a sad peculiarity of the municipal bodies of England that they are always disposed to listen to those whom it is the fashion to call "practical," in contradistinction to "scientific" men, as though the mere fact of working "by rule of thumb" gave men truer insights into the laws of nature than long study and careful observation. At Brighton this seems emphatically to have been the case, and in a report addressed to, and received by, the Board of Guardians, the opinions of three practical well-borers are quoted as to the probable cost of continuing the well at Warren Farm, but no opinion seems to have been asked from such men as Mr. Hawksley, Mr. Mylne, or Mr. Homersham, who have brought great experience and deep study to bear on the hydrographical conditions of this district on other occasions. It is one of the fashionable theories of the day that a scientific education incapacitates a man for the exercise of a profession, and that the most able men in any branch of art or science are those who have not been brought up to pursue it. Under these circumstances it may not be surprising, however unfortunate it may be, to find empiricism preferred to science, or that the Brighton Guardians should avoid taking the opinions of really eminent engineers.

In stating, in the previous part of this paper, that I should return to the question of the abnormal beds met with at Highgate, I had especially before my mind's eye the cases of the well sunk under my own orders at Warnham Court, near Horsham; and at Red Hill, by my friend Mr. Docwra. In the former case, the boring, after it had been carried through the sandstones, clays, and shales of the upper Wealden deposits, passed at a depth of 142 feet from the surface into a bed of red clay and sandstone intermixed. At first, I believed, from the external characters of the materials, that they were of the same nature as the beds found at the bottom of the Kentish Town well, and I was supported in this opinion by several distinguished geologists to whom I showed the samples. As the Kentish Town beds were, at the time I refer to (about five years since), universally considered to be members of the new red sandstone series, of course I regarded the Warnham bed as one of the same range. But Mr. Docwra, at Red Hill, after he had traversed the sands and loams of the subcretaceous series to a depth of 438 feet, passed into a bed composed of red clays and particles of red sandstone, which were identical with the Warnham beds, and with some members of the Wealden series. It seems, therefore, to me to be very probable that the Kentish Town beds may be members of the Wealden series, but the solution of this question has simply a geological interest, for alike, the Weald clays, and the new red sandstone clays, are without water; and, under these circumstances, the wisest course to be adopted was to stop the further progress of the works in all such cases as Warnham and Red Hill, unless they were carried on distinctly as philosophical experiments.

The well at Rugby, though it has proved to be, no doubt, a source of annoyance and disappointment, may eventually turn out to be of importance to the commercial interests of the locality. It was commenced with the hope of finding in the new red sandstone series under the lias, some water-bearing strata which might be able to furnish a supply to compensate for the deficiency under which the town of Rugby was suffering, after it had been put to the expense of carrying out the absurd crotchet of the so-called "gathering grounds" system. A boring has here been carried down to a great depth in the new red sandstones of the triassic group, which, at Liverpool and Birkenhead for instance, frequently supply large quantities of water. At Rugby, however, the boring at present has only yielded a brackish water, and I suspect that now all hopes of securing the result desired by the Local Board of Health by this well must be abandoned, unless the Board determine upon tubing the bore-hole throughout its length, and upon continuing to sink to a much greater depth. It is possible that, within a moderate distance from the bottom of the present well, stronger brine springs than those now brought to the surface may be found, which it would be possible to evaporate economically for the purpose of salt making; but a very careful comparison between the strata of this locality and of those near Derby or Droitwich, would be required before any decided opinions could be formed as to the probability of finding soft water within a reasonable distance from the surface at Rugby.

The well at Great Yarmouth, executed by Sir E. Lacon and Co., is of interest, on account of its showing the great depth attained by the tertiary strata on the east of England; but, unfortunately for the spirited proprietors, the results, so far as water supply is concerned, have been "negative." The depth of the tertiaries here was found to be 527 feet, and the first 170 feet of this thickness were composed of recent estuarine and blown sand, deposits of very recent formation. At Norwich, Messrs. Colman are steadily pursuing an experimental boring, which has already passed through the chalk to a depth of 1,158 feet, the upper green sand to a depth of 8 feet, and the gault to a depth of 30 feet; the works have been suspended in this formation on account of some accident to the machinery, but when this shall have been repaired, they will, no doubt, be resumed. It may be necessary to descend 150 feet lower before reaching the water-bearing stratum, but the comparative success of Mr. Lankester Webb's well, at Stowmarket, affords good reason to hope that Messrs. Colman's perseverance will ultimately be rewarded. I do not anticipate, however, that the water will overflow the surface, because the lower green sand is traversed by one of the affluents of the Ouse, near Downham market, at a comparatively low level.

In a paper which I had the honour of reading in this room last year, I alluded to the very successful borings made by the Kent Water Works Company, in the Ravensbourne Valley, and this evening I am enabled to lay before you a section, showing the strata they traversed. One reason for my doing so is, because I have heard that some parties propose, as I said in the opening paragraph of this paper, to sink artesian wells near London for the supply of the metropolis; and I think it desirable to state, for their guidance, that, unless they meet with the peculiar conditions of the faults of the Ravensbourne Valley, they are not likely to obtain a large supply of water from the chalk on the north side of the Thames, whilst there is no chance whatever of their finding water below the chalk. There are, no doubt, copious and beautiful springs given off from the head valley of the Lea and the Coln, both of which rise in, and are fed, by the chalk; but those springs may, in almost all cases, be shown to be connected with some geological disturbance of the strata, and the only locality near London where there seems to me to be any chance of obtaining a large quantity of water from the chalk, would be on the left bank (or the west) of the river Lea, somewhat to the north-east of Stratford, because there is about that district a line of disturbance in the chalk parallel to the great fault which brings to the surface the springs lately tapped near New Cross, and those of Grays, in Essex.

Finally, it must be evident to anyone who reads attentively the records of the success and of the failure of the attempts above-mentioned, that the execution of artesian wells is an operation which should only be entrusted to skilful and well-tried men, acquainted with the theory and practice of their art. No such work should be commenced without a careful preliminary survey of the geological and hydrographical conditions of the country extending over a very wide range. This is seldom done, because public bodies, in England at least, do not seem to object to pay for engineers' blunders and miscalculations, but they do object to pay for their study, and it is at once assumed that because artesian wells have succeeded in one case they must succeed in all. But even when the greatest amount of skill and science have been brought to bear on the preliminary investigations for the establishment of an artesian well, it is impossible to predict with any certainty what the result of sinking a shaft or a boring may be in a stratum hitherto untried. Moreover, every artesian source of supply is limited in amount, and even in the case of the Paris basin it would be desirable to watch the effects of the increased draught upon the lower green sand during a dry summer, especially before commencing, as has been proposed, the execution of a large number of wells like those of Passy and of Grenelle.

The student who may desire to obtain a complete view of the subject thus briefly referred to, would do well to consult the works of Messrs. Prestwich, Mylne, Clutterbuck, Homersham, Degoussée, Burat, Hericart de Thury, Garnier, &c., the Transactions of the Institution of Civil Engineers, the Comptes Rendus of the Académie des Sciences, and of "Les Ingénieurs Civils" of France. I am myself under great obligations to Messrs. Hawksley, Lockwood, Wells, Chamberlain, Docwra, Prestwich, Morris, Snider, and others, for the sections and information so liberally supplied to me.

I may here add that in the number of *La Presse Scientifique*, for the 16th January of this year, I find a notice of a well lately sunk at Columbus, Ohio, U.S., which is not less than 2,575 feet deep. The thermometer (on the system invented by Mr. Walferdin) registered a temperature of 88°; this would seem to show that the law of the increase of temperature is rather slower in Ohio than it is near Paris. No particulars are, however, given of this important boring.

DISCUSSION.

Mr. ROBERT RAWLINSON (responding to the invitation of the Chairman) felt personally obliged to Mr. Burnell for his paper, and for the facts laid before the meeting, but would have preferred that it should have been divested of some appearances of personality in the remarks with regard to the acts of municipal corporations, and other local public bodies. A great number of facts had been brought before them, which served, he thought, to teach them a considerable degree of modesty in coming to conclusions on these matters. They might, however, draw this conclusion, that it did not follow, because water was found under certain conditions in one locality, that operations of a similar character, and under apparently the same conditions, would be attended with equal success in another locality. With regard to failures, he thought the Rugby instance had been very gently and tenderly dealt with. That well was sunk at great cost, but they failed to get fresh water. They could only pump brine from it, which, they were told, might be turned to a profitable account if they could get enough of it. The wells at Paris must be pronounced a great success, as far as they went, but if they thought they could sink wells 2,000 feet deep in this country and obtain water under the same conditions, the probability was that nine attempts out of ten would prove failures. They might take it as a fact, that there was no fresh water beneath the surface of the earth's crust, which had not come from the surface. There was no water which they could obtain, fit for domestic purposes, which was not evaporated from the ocean, and they might take it that, under all circumstances, the greater the depth of the well was the more worthless for those purposes was the water; in the majority of instances water drawn from deep borings would be more highly impregnated with mineral matters than water obtained nearer the surface. It was found that chalk waters generally had about the same degree of hardness under all conditions; for every million tons of such water they had a ton of carbonate of lime. If they sunk a well in the chalk they must take into account that they would bring this carbonate of lime with the water. The same might be said of the new red sandstone, which generally gave water of some known hardness. Dr. Angus Smith, after having analysed many hundreds of samples of water, said if they told him the nature of the stratification he would tell them what the water was, or by analysing the water he would tell them what the stratification was. In advocating deep wells, they must take into consideration that the water would be charged with mineral matters almost in proportion to the depth of the well. He thought great fallacies were entertained with regard to the water-bearing power of the earth. He had heard it said that they had only to go deep enough to get water in abundance. That was not correct. Take the new red sandstone series: they would have an abundance of water at a depth of 300, 600, and in some instances 900 feet. In sinking deep coal shafts—as in the case of the Monkwearmouth mine, which was 1,800 feet deep, they were troubled with enormous quantities of water at the deepth of 900 feet; but at the depth of 1,800 feet they had to send water down for use in the pit. The same might be said of the deep shafts at Dukinfield, near Manchester. They had large water-bearing strata at from 600 to 900 feet deep, and having sunk beyond them, the strata were perfectly dry. The only filtration there was brine of the strongest character. Some time ago he was down the Monkwearmouth mine, and there was a small trickling of water down the sides of the shaft, which proved to be a strong brine, whereas at the depth of 600 feet they tapped enormous volumes of the ordinary magnesian limestone water. Now, any person who had practically to do with wells, would soon find that it was easy to read up all that could be said on the question, but the difficulty was to put it into practice. He had recently been engaged in sinking several wells himself, and had come to grief with one or two of them. He had a well now on his hands which had been nearly two years in work, and cost £2,000, but it had failed from the collapsing of the cylinder in the quicksand. The practice of artesian boring and well-sinking was one which might be of the greatest possible use in different regions of the earth; and it was a great thing to find that in the sterile deserts of Arabia, water could be obtained in many parts; and he had no doubt in many other regions where the surface was arid, if proper attention was paid to the stratification, water in moderate quantities might be found.

Mr. **ROBERT MYLNE** would bear his testimony to the value of the paper they had heard—a paper full of important facts. The illustrations on the walls were also valuable from having all been drawn to the same scale. There was one thing with regard to the Brighton well which had struck his attention—that was the breaking of the vertical line in sinking the shaft by forming a short horizontal gallery some way down, and constructing the lower portion not in a direct line with the upper. He should be glad if Mr. Burnell, or any other gentleman present, could inform them why so extraordinary a course had been adopted in that instance, as it struck him that considerable inconvenience must arise from it. One other remarkable feature of that well was, the great depth to which the shaft had been carried instead of boring. He had never heard of a shaft being carried down 1,100 feet, unless there was some peculiar object to be gained.

Dr. **MOSSOM MEEKINS** suggested that it would be interesting to know what amount of money had been expended on these wells, and with what results. He did not agree with Mr. Burnell in the statement that municipal bodies were not justified in sinking such wells. He thought it was a question with the ratepayers alone, and if they did not complain, no one else had a right to do so. He thought it a libel in the present day to say that professional education did not carry its due weight. Frequent cases were met with of uneducated ability in particular branches of science, and in such instances he thought every facility should be given to those who displayed that ability. Such men would be ornaments to any profession, and he thought there never was a time when scientific knowledge was valued so highly as at the present day.

Dr. **LANKESTER**, F.R.S., said this was rather an engineering question than one bearing upon public health or other subjects to which he had specially devoted his attention. But he felt a great interest in some of the wells spoken of, inasmuch as two which had been mentioned in the paper were sunk by relatives of his, and he was well acquainted with another. He especially referred to the wells at Southampton, Stowmarket, and Harwich. With regard to those examples, he thought it was interesting to find that in the paper, particulars as to the causes of the failure of these wells were given, which could hardly be got on the spot. With regard to the Southampton well, he believed it was a moot question whether the failure arose from an interruption of the water-bearing strata at that spot, or whether it was from the geological structure of the whole country. General James had sunk a well at Portsmouth, from which he succeeded in obtaining a full supply of water; and he (Dr. Lankester) believed that at the time the Southampton well was commenced, the General gave his opinion that it would not succeed on account of its geological position. He mentioned this to show that the well at Southampton was commenced apparently without sufficient scientific consideration of the subject to warrant the large expenditure that had been incurred upon it, and he thought it highly improbable that any considerable amount of water would be got from that spot. On the other hand, the Stowmarket well was a great success, and he had a favourable opinion of it before it was commenced. With regard to the Harwich well, it was remarkable that it should have been undertaken so near the harbour and the sea; under such circumstances one might almost anticipate failure. The failure was attributed to the boring having reached the clay slate rock spoken of in the paper, which appeared to be almost a primitive rock, as hard and as brittle as any rock in Wales would be. Considerable doubts had been raised as to the nature of that rock. Some persons had supposed it to be an exceedingly hard portion of gault, and if that were bored through it was thought soft water might be obtained. He thought if they had gone deeper they would have got water. There was another well at Walton-on-the-Naze; he was not aware whether that had succeeded or not. Looking at the whole of these sinkings, they were rather discouraging, with all the knowledge that had been brought to bear upon them, for in the majority of instances they had been failures. This showed how careful persons should be before they commenced the expenditure of large sums of money on such works. At one time, he entertained the notion that they might derive a large proportion of the water supply of London from artesian wells. The authorities of St. James's, Westminster, proposed to sink a well in that parish, in order to obtain a supply of water, and the opinion of Mr. Godwin Austen was decidedly favourable to their being able to obtain a large supply in that district; however, the rights of the water companies seemed to frighten the authorities, and the plans were never carried out. In some districts of the metropolis he thought this system might be prosecuted with every probability of success, but in other localities they might meet with difficulties. The Kentish-town well was an extraordinary instance of want of success. One great element in this question was the nature of the water obtained from these sources. It was true the lower they got into the chalk, or through the chalk, the more the water became charged with inorganic constituents; but he would say those constituents did not render the water much less desirable for drinking. The human blood itself contained no less than 480 grains of saline matter per gallon, and for the most part those were the constituents of the inorganic impurities of the water, and, therefore, these could not be so objectionable as was sometimes represented. But organic constituents in water were objectionable, and in that respect the deep wells had the advantage over the shallow ones. No doubt in shallow wells there were dangerous impurities from the surface water which got access to them, and those organic matters in a state of decomposition would produce injurious effects upon the human system. Hence he said, avoid surface water wells. There was, however, a certain amount of organic matter in the water of deep wells. It occurred to him that the sulphuretted hydrogen which was detected in the wells of Grenelle and Passy had arisen from a small quantity of organic matter in the water. He did not know that that was injurious to health, at the same time, when the presence of sulphuretted hydrogen was indicated, the water ought to be closely looked to, but a small quantity might sometimes occur without necessarily producing disastrous effects on the human system, and without indicating any great amount of organic impurity. It seemed if they could get supplies of water from these deep wells, it would be more free from organic matter than the water obtained from the rivers, owing to the latter being exposed to the impurities of animal and vegetable matters, and it was no doubt desirable that the water of towns should be supplied from these deep wells, if it were possible to obtain an adequate supply from such sources. He hoped that clear principles would be laid down, so that public bodies might not be deterred from prosecuting these works by the apparent difficulties which beset them.

Mr. Robert Hunt, F.R.S., remarked that his friend who had just addressed them appeared to be alarmed at the public drinking the water at present supplied to our towns, owing to the organic matter which it contained. There was no question but that in a great metropolis like this the surface water was rendered injurious from a variety of causes. He could not, however, agree with Dr. Lankester in condemning the deep well water in which they had the presence of sulphuretted hydrogen, as indicating organic matter likely to be injurious. He would mention that water taken from wells in the neighbourhood of the town of Leeds when first drawn was beautifully clear, free from smell, and altogether agreeable. In from six to twelve hours after it was drawn it became very offensive, possessing the offensive odour of rotten eggs; but if they allowed the water to stand twelve hours longer it became inodorous and delicious, the hydro-sulphate of lime was precipitated, and all that was offensive disappeared. He had known the same peculiarity to have occurred in water drawn from the deepest mines in Cornwall at a depth of 200 fathoms, which, when exposed to the action of the air at the surface, gave indications of sulphuretted hydrogen, but he discovered that it was the hydro-sulphate of ammonia which gave out that peculiar odour. In all cases of water from the deep mines of Cornwall—and he had no doubt it would be found to be the case at Grenelle and Passy—they discovered that this was due to the decomposition of iron pyrites, being brought into contact with some form of carbonaceous matter, such as was found in the coal formations; but he believed such water as that might be drunk without any injury to health.

Dr. Lankester explained that he had extensively investigated this subject in Yorkshire, and he did not think that the effect referred to was produced by the decomposition of sulphide of iron, but probably of a sulphate; it was only the soluble sulphates which produced sulphuretted hydrogen.

Mr. Mason would add his testimony to the uncertainty of the quality of water obtained from deep borings. He had been engaged in boring through the chalk at Tilbury, and he obtained water which was very salt at a depth of 580 feet, and strongly impregnated with iron. At Battle Bridge, in Essex, the water, when first drawn, was pure and agreeable to the taste, but, like that described by Mr. Hunt, had an offensive odour afterwards, again becoming pure. It was satisfactory to know that if they could not obtain water for the supply of the metropolis from a great depth, they could obtain it from the surface of the chalk. From the well at Grays, 4,000,000 or 5,000,000 gallons per day were discharged into the Thames, which water was perfectly free from organic matter. There was a large supply of water in the chalk, available to help the present water supply of London.

Mr. Robert Rawlinson wished to add a remark with reference to the well at Harwich. The failure of that well had been imputed to its having been sunk at or near the level of the sea, without provision being made to exclude the salt water. It did not follow that because the stratification was at or near the level of the sea, if proper means were taken to exclude the salt water, they could not reach the fresh water, and bring it to the surface. Neither ought such a circumstance to deter them, for the future, from sinking wells at or near the level of the sea for fear of tapping the salt water in the well they were going to sink. There was a well at Worthing, commenced by Mr. Ranger, which was 30 feet above the level of the sea. It had been sunk and bored to the depth of 360 feet into the chalk stratification. It yielded chalk water from the commencement, which afterwards became more abundant and of better quality. As a rule, it would be found that the water-bearing stratum was not confined to the sea level. The land was above the general sea level. The fresh water due to evaporation, flowing from the surface, was received as into a basin; the surface of the basin being for the most part above the sea level, the delivery of the water was at or below the sea level, and a great quantity was delivered along the margin of the rivers and sea shore. He knew that there was a fear of sinking wells at or near the level of the sea at Brighton and at Dover, under the apprehension that they would get at the salt water. He believed they might go to the depth of 100, 200, or 300 feet below the level of the sea without fear of touching the salt water.

Mr. Robert Hunt wished to mention one fact—that was that salt water filtered through sand became perfectly fresh. Although it was true they got the largest portion of well-water from that which flowed upon the surface of the earth, yet they also obtained a large quantity from the infiltration of water from the ocean. In the mines under the Atlantic Ocean, the water having filtered through 30 fathoms of rock, became nearly fresh. The experiments of Dr. Normandy proved that salt water filtered through 50 feet of sand came out fresh.

The Chairman concurred in the observations just made, because he had been engaged in works at Spithead, about a mile from the shore, and he found they were getting fresh water there. He also concurred with what had fallen from Mr. Rawlinson. It was not a question whether they bored near the sea or quite inland, if they went far enough into the earth to get beyond the reach of the sea water. With respect to the sinking of wells generally, his impression was that persons did not usually resort to that mode where they could avail themselves of supplies from the streams and rivers, but there were many cases where the rivers could not be made available, and then the supply of water became in a great measure matter of speculation, and it was problematical whether the speculation would turn out profitable or not. So he believed it would continue to be the case with regard to these wells; at the same time it was proper that they should avail themselves of all the information they could get on the subject, whether scientific or otherwise, so as not uselessly to expend large sums of money, whether that of corporations or private persons. There were several important considerations bearing upon the question of supplies of water from artesian wells. In the first place, in providing for the supply of water to a large town, the quantity obtainable ought to be known, whereas, in the case of artesian wells, the supply was unknown and the quantity might be limited. Nobody could tell what quantity the reservoir of an artesian well contained. That was an uncertainty which belonged to the supply of water from such sources. He had seen plans for supplying London with water from a well at Watford, which it was alleged could be done without affecting the river Colne. He believed that to be fallacious. If they began to take away from the constant quantity, which could only be supplied from rainfall, they must at last pump water even from the artesian wells which had been derived from the surface. They found in London the wells were lowering considerably, and the same was the case at Liverpool, and therefore he should be sorry to see the attempt made to supply London with water from wells of this character. There could be no doubt it was a question of quantity, which was one that they could not ascertain, and the quantity might be rapidly diminished if they increased those wells to any considerable extent, and he thought that was an additional circumstance to deter them from endeavouring to adopt this mode of supply. He begged to propose a vote of thanks to Mr. Burnell for his able paper.

The vote of thanks having been passed,

Mr. **Burnell**, in acknowledging the compliment, replied to the observations of Dr. Lankester with regard to the Harwich well, describing the nature of the strata there. Having offered some general observations upon the increase of mineral admixtures in proportion to the greater depth from which the water was obtained, he concluded by thanking the meeting for the manner in which his paper had been received.

The Secretary announced that on Wednesday evening next, the 5th February, a Paper by Dr. F. Crace Calvert, F.R.S., "On the Improvements and Progress in Dyeing and Calico-Printing since 1851," would be read.

LITERARY AND ARTISTIC COPYRIGHT IN FRANCE.

The *Moniteur* of the 23rd inst., announces that the Commission on literary and artistic property, appointed by Imperial decree of the 28th December last, met on Wednesday, under the presidency of Count Walewski, with Count Persigny and M. Rouland as vice-presidents. The official journal reports in full the speech delivered on the occasion by the Minister of State presiding, from which we gather that it is intended to extend the rights of authors from the present limit of thirty years after decease, either to fifty, or to perpetuity. The idea of the Imperial Government evidently is to prolong the author's right to the farthest term. In the course of his address, Count Walewski remarked:—"When we think how few men, but what men, would benefit by this just favour, we ask ourselves what danger there would be in making a law that should eternally protect some rare *chefs-d'œuvre*, whilst so many poornesses die before their authors—when so few survive them to the term of thirty years, for them too distant, whilst it is but a first stage to those that are to live for ever! Seeing that the works of great masters have been doing honour to France for more than two centuries—that they are enriching the booksellers who publish them, and the theatres who play them—how is it to be understood that they should not nourish the heirs of their illustrious creators. Time soon wears off with itself bad works, while as to good, it seems just that they should be as productive as they are durable, and that their fortune should have no other limit than that of their value and success."

The conclusion of the speech was as follows:—"The Commissions of 1825 and 1836 declared in their reports that in principle they were favourable to perpetuity, and that they skrank from it solely on account of the difficulties that would result from its application. Before them, illustrious names had spoken to the same purpose—Diderot, Voltaire, the Advocate-General Séquier; at a later period, Count Portalis, de Montalembert, Victor Hugo, and Phillippe de Ségur; and in 1841, the reporter on the law presented to the chambers a proposal for extending the right of literary property to thirty years. Hear what M. de Lamartine says in a last effort in favour of perpetuity:—'I demand fifty years for the rights of intellect, because I feel that perhaps the moment is not yet come to grant it more; but, on the day that you proclaim the perpetuity of literary property, you will have emancipated human thought.' Is that day come, gentlemen? Have the objections that were offered against the application of the principles of common right to literary property lost none of their value? Is it now allowable, in the state of our laws, to consecrate the right which the authors of literary and artistic works ought to have, like the authors of every other production, of disposing freely and in perpetuity of the fruit of their labour? I said to you at the commencement, gentlemen, and I say to you again, to you it belongs to settle these grave questions. The Emperor awaits the results of your labours. Confiding in your intelligence, his Majesty cannot doubt that from the discussion about to open will issue the solution most favourable to the true interests of literature and the arts."

After this address, which was listened to with the deepest interest, the general discussion was adjourned to a future sitting.

THE MOZARD MINER'S SAFETY LAMP.

The body of this lamp is provided with a male screw, and the frame supporting the upper portion or top has a corresponding female screw. This frame has a cavity to receive a bolt, which is forced into it by a spring, and the top of the bolt having an inclined surface, it follows that when the lamp is lighted the top can be screwed on, but cannot return unless the bolt be lowered. The axis which carries the wheel for raising the wick has a projection which, upon the wick being lowered as far as possible, depresses the bolt; this lowering of the bolt, cannot, however, take place until the wick is drawn completely within the tube and extinguished. The lowering of the bolt whilst the wick is alight is effectually prevented by providing that the wheel for raising the wick cannot make more than seven-eighths of a revolution. This, if such a wheel be one inch diameter, will allow two-and-a-half inches of wick to be burned before re-trimming the lamp, and is calculated to burn continuously for eighteen hours. The lamp has a solid iron chimney in the gauze top, so that it is impossible either to remove the top or to draw the flame through the gauze. The glass is about three inches in diameter, and one-quarter of an inch thick, and the supports which carry the upper parts of the lamp would prevent the glass being broken, unless wilfully. The double plate above the gauze keeps the hand ring cool.

Proceedings of Institutions.

Brompton Church of England Young Men's Society.—In the eleventh annual report of this Society, presented at the annual meeting, on the 28th of October last, the Committee say that though they have not to speak of any considerable progress, they trust it will on the whole be found to be satisfactory. The number of the members remains about the same as last year. Several new members have been elected, but not more than to fill up vacancies occasioned by death and removal. The lectures, an important branch of the Society's operations, have been better attended during the last year than formerly, and the best thanks of the members are due to those gentlemen who kindly gave their services gratuitously. The following lectures were delivered during the past year:—Major Lovell, C.B., R.E., "Popular Delusions;" Captain Drew, 3rd Depôt Battalion, "The Ten Persecutions of the Early Christians;" the Rev. D. Cooke, "Tyndall and our English Bible;" the Rev. D. D. Stewart, M.A., "Home;" Lieut. D. C. Walker, R.E., "Climate;" the Rev. J. B. Owen, M.A., "Haunted Houses, with Sketches of the Spirits in the School, the Tap, the Asylum, the Lone House, the Fast House, and the Last House;" Benjamin Shaw, M.A., "The House of Commons;" the Master of the Temple, "The Life and Character of Bishop Heber." The result of the Society of Arts Examination has proved equally successful with that of the former year, six members having obtained certificates. The Committee trust that as the Society of Arts Examinations are better understood, a larger proportion of young men will be found to offer themselves as candidates for the certificates and prizes annually distributed. To those gentlemen who form the Local Board the best thanks of the Society are due for the kind and efficient manner, in which they have conducted the examinations. The library catalogue contains a list of 600 volumes. There is, however, an increasing demand for new and useful books. The Committee venture to make their wants known in the hope that honorary members and friends of the Institution may be induced to present works to the library, or to give donations towards this laudable object. The periodicals still continue to be highly appreciated amongst the members. The weekly change at the members' houses without any additional charge is a peculiar feature of this Society, and gives the greatest satisfaction. The Committee urge upon the members of this Institution the importance of giving greater publicity to the circumstance that ladies are admitted as members, are free to attend the lectures, and to enjoy the advantages of the library. A Literary Class was formed at the beginning of last year, of the progress of which the Committee are able to report favourably. Other classes the Committee hope may be opened so soon as a sufficient number of names are forwarded to the Secretary. In conclusion, the Committee, in urging upon all the members hearty co-operation in this work, say:—" We unite ourselves to this Society for our own individual advantage and improvement, but this is not all, we are combined together for a common object, to make aggression upon the ignorance and immorality around us. We ask young men to join us, not only that they may find a common centre of sympathy, but that they may become workers with us to promote the religious, moral, and intellectual improvement of those amongst whom we dwell."

Lockwood Mechanics' Institution.—The annual gathering of the members and friends of the Institution took place on Christmas Eve. In the unavoidable absence of the President, Bentley Shaw, Esq., J.P., the chair was occupied by Mr. S. Lodge. The chairman stated that a prize had been kindly offered by Mrs. Bensted to any girl in the sewing classes for the best made shirt. Mrs. Bensted's object was to encourage sewing, &c., amongst the girls of the Institution, and he, the chairman hoped they would show by their future diligence and industry a proper appreciation of her kindness. He would urge upon the boys also the necessity of attending the classes regularly and punctually, with a view to compete for prizes, for he believed there were gentlemen in the neighbourhood ready to follow Mrs. Bensted's example. The proceedings were varied by singing and reciting, and the evening was spent in a very satisfactory manner. Mr. John Liversedge presided at the piano.

MEETINGS FOR THE ENSUING WEEK.

Mon......Geologists' Association, 7. 1. Mr. C. B. Rose, " Cretaceous Group of Norfolk." 2. Mr. C. Tomlinson, " Plasticity of Clay."
Entomological, 8.
British Architects, 8.
Medical, 8½. Mr. Henry Smith, " On the Difficulties and Dangers attending the operation of Tracheotomy."
Royal Inst., 2. (General Monthly Meeting.)

Tues. ...Civil Engineers, 8. Renewed Discussion " On Iron-Plated Ships."
Pathological, 8.
Photographic, 8. (Anniversary Meeting.)
Ethnological, 8.
Royal Inst., 3. Mr. John Marshall, " On the Physiology of the Senses."

Wed. ...Society of Arts, 8. Dr. F. Crace Calvert, F.R.S., " On the Improvements and Progress in Dyeing and Calico-Printing since 1851."
Geological, 8. 1. Mr. E. Hull, " On Isodiametric Lines as means of representing the Distribution of Ordinary Sedimentary as distinguished from Calcareous Strata, with special reference to the Carboniferous Rocks of Great Britain." 2. M. P. de Tchihatcheff, " On the Recent Eruption of Vesuvius."—Communicated by Sir R. I. Murchison. 3. Sign. L. Palmieri, " On some Volcanic Phenomena observed at Torre del Greco."
Pharmaceutical, 8.

Thurs...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. 1. Mr. John Lubbock, F.R.S., and L.S., "Notes on the *Smynthuridæ*." 2. Mr. A. Murray, " On the Geographical Relations of the *Coleoptera* of Old Calabar."
Chemical, 8. 1. " Mr. Adie, " On Ground Ice." 2. Dr. Bence Jones, " On Crystalline Xanthin in human urine." 3. Mr. A. H. Church, " On Silica." 4. Prof. Bloxam, " On Arsenic in Sulphuric Acid."
Royal Soc. Club, 6.
Artists and Amateurs, 8.
Royal Inst., 3. Professor Tyndall, " On Heat."

Fri. ......Royal Inst., 8. " Prof. T. H. Huxley, " On Fossil Remains of Man."
Archæological, 4.

Sat.......Roy. Botanic, 3¾.
Royal Inst., 3. Rev. A. J. D'Orsey, "On the English Language."

PATENT LAW AMENDMENT ACT.

◆

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 17*th*, 1862.]

Dated 1*st January*, 1862.

16. W. E. Newton, 66, Chancery-lane—Imp. in coffee pots and boilers for culinary purposes, part of which imps. are also applicable for generating steam. (A com.)

Dated 2*nd January*, 1862.

18. W. E. Gedge, 11, Wellington-street, Strand—Improved apparatus for roasting coffee. (A com.)
21. M. Cartwright, Carlisle—Imp. in the manufacture of models and of " plates" or " pieces" for artificial teeth.
23. H. Eschwege, 44, Mincing-lane—Imp. in treating wood and other vegetable spirit.

Dated 3*rd January*, 1862.

24. E. Nugent, Brooklyn, New York, U.S.—Imp. in fire-arms.
26. F. S. Belloche and H. Bollack, 42, Bridge-street, Blackfriars—An improved parasol.

Dated 4*th January*, 1862.

29. J. W. Arundell, 265, Gresham-house, Old Broad-street—An improved method and improved apparatus for removing impurities from coal, parts of which invention are applicable for the separation and cleansing of ore and other minerals. (A com.)
31. C. Cross, Stratford, near Manchester, and E. Padmore, Manchester—Imp. in the manufacture of piled fabrics and in machinery or apparatus employed therein.
33. G. Leyshon, Tividale, and D. Beckley, Brockmoor, Staffordshire—An imp. or imps. in breaks for retarding and stopping carriages on railways.
37. A. Warner, 31, Threadneedle-street—Imp. in preparing materials for and in purifying coal gas.

Dated 6*th January*, 1862.

40. G. Betjemann, G. W. Betjemann, and J. Betjemann, Pentonville—Imp. in dressing cases, applicable to other cases and boxes.
41. P. B. O'Neill, Hart-street, Bloomsbury—Imp. in screw wrenches or spanners.
43. F. Brown, Luton, Bedfordshire—Imp. in kitchen ranges and cooking apparatus.

Dated 7*th January*, 1862.

45. J. Higgins and T. S. Whitworth, Salford, Lancashire—Imp. in machinery or apparatus for spinning and doubling cotton and other fibrous materials.
48. A. Wallis and C. Haslam, Basingstoke, Southampton—Imp. in rotary screens.

Dated 8*th January*, 1862.

49. D. Beale, 10, Cobden-street, Saint Leonard's-road, Bromley, Middlesex—An improved mode of fastening iron plates to ships' sides.
51. A. Heath, 12, Union-square, Islington—Imp. in the construction of inkstands.
53. C. Pilkington and T. Pilkington, Sheffield—Imp in skates.
55. J. Stenhouse, 11, Upper Brunswick-terrace, Barnsbury-road—Imp. in rendering certain substances less pervious to air and liquids.
57. W. Bradshaw, jun., Coventry—Imp. in watches.

[*From Gazette, January* 24*th*, 1862.]

Dated 14*th September*, 1861.

2298. T. Morris, R. Weare, and E. H. C. Monckton, 4, Trafalgar-square—Imp. in batteries for obtaining electric currents and the products therefrom.

Dated 18*th September*, 1861.

2324. J. G. Briggs, 23, Earl-street, Blackfriars—An improved method of making fire-proof buildings, ships, and other constructions.

Dated 30*th September*, 1861.

2431. T. Smith, Aberdeen-street, Sheffield—Imp. in the construction of umbrellas adapted to purposes of self-defence, some of which imps. are also applicable to other purposes.

Dated 23rd October, 1861.

2643. G. H. Birkbeck, 34, Southampton-buildings, Chancery-lane—Imp. in processes or means employed for separating or extracting silver from lead. (A com.)

Dated 2nd November, 1861.

2763. T. Spencer, Prescot, and T. Robinson, St. Helen's, Lancashire—Imp. in machinery or apparatus for making pipes and other article of earthenware, and in the form of pipes for gas, sewage, and other purposes. (Partly a com.)

Dated 12th December, 1861.

3113. W. Lightfoot, Harwell, Berkshire—An improved bridle.

Dated 18th December, 1861.

3175. C. E. Symonds, 56, Stone's End, Southwark—Imp. in the treatment and application to various useful purposes of light spirituous liquids.

3177. J. M. H. A. Taurines, Paris—Improved mode of constructing balances, weigh bridges, and other weighing machines.

Dated 19th December, 1861.

3183. E. Stott, Ashton-under-Lyne—Imp. in apparatus used for collecting and removing the waste and dirt which occurs in the process of spinning cotton and other fibrous materials.

Dated 20th December, 1861.

3203. D. C. Le Souef, Twickenham—An imp. in cylinders used in printing calicoes and other textile fabrics. (A com.)

Dated 21st December, 1861.

3207. F. Grimaldi, 13, Manchester-buildings, Parliament-street—Imp. in rotatory steam boilers.

Dated 26th December, 1861.

3229. J. Jones, Liverpool—Imp. in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like nature, fusible at a low temperature into sheets of any thickness or length, and in the apparatus connected therewith.

3231. L. J. Taulin, 4, South-street, Finsbury—An improved wind musical instrument.

Dated 30th December, 1861.

3255. J. Gorton, Park-house, Gateshead, and B. Henderson, South-shore, Gateshead—Imp. in the manufacture of ropes.

Dated 31st December, 1861.

3264. N. McHaffie, 16, Summer-street, Mile-end, Glasgow—Imp. in ventilators or valves for regulating the passage of air or other fluids, whether of a gaseous or liquid form.

3275. R. A. Brooman, 166, Fleet-street—Imp. in revivifying animal black or charcoal, in collecting ammoniacal gases generated in the revivification, in the clarification of saccharine liquors, and in apparatus employed in the revivification of the black, and in the filtering of saccharine liquors. (A com.)

3276. A. Edward and J. Edward, Dundee—Imp. in machinery or apparatus for spinning fibrous materials.

Dated 1st January, 1862.

2. N. C. Szerelmey, 6, Park-terrace, Brixton—Imp. in the manufacture of leather cloth or imitation leather, and in rendering certain fabrics waterproof.

4. T. Hall, Odiham-wharf, Odiham—An improved apparatus for removing weeds from canals, rivers, and lakes, after such weeds have been cut with a chain, scythe, or other machine or implement applicable to that purpose.

Dated 2nd January, 1862.

20. W. A. Fell, Troutbeck-bridge, Windermere—Imp. in the manufacture of bobbins and in the means or apparatus employed therein.

Dated 4th January, 1862.

28. J. W. Arundell, 265, Gresham-house, Old Broad-street—An improved method and improved apparatus for treating and dressing ores and minerals, particularly applicable to tin, lead, copper, zinc, and iron ores. (A com.)

30. J. W. Arundell, 265, Gresham House, Old Broad-street—An improved method of, and apparatus for, communicating motion to fan ventilators, particularly applicable to ventilating mines. (A com.)

32. R. H. Cotter, Cambridge-heath—An improved apparatus for instantaneously lighting certain lamps, and, when desired, extinguishing the same.

Dated 6th January, 1862.

38. J. Coryton, Rolls-chambers, 89, Chancery-lane—An improved type machine.

42. W. T. Kite, Mongewell Mill, Wallingford—Imp. in the manufacture of starch, and in apparatus employed therein.

Dated 8th January, 1862.

52. S. Jesson and J. Batson, jun., Smethwick, J. Moore, jun., Langley, near Oldbury, and J. Roberts, Smethwick—Imp. in the manufacture of gun barrels and wrought-iron tubing.

54. J. Barber, Preston—Imp. in hand mules, consisting of a break and backing-off motion.

56. H. Bessemer, Queen-street-place, New Cannon-street—Imp. in the machinery and apparatus employed in the manufacture of malleable iron and steel.

Dated 9th January, 1862.

60. J. Smith and S. Wellstood, Glasgow—Imp. in cooking stoves or ranges.

62. T. A. Weston, Birmingham—A new or improved multiplying gearing for transmitting and multiplying power, which said gearing may be applied to cranes, windlasses, capstans, and presses, and to other purposes where it is required to transmit and multiply power.

64. H. Charvet, Lille, France—Imp. in the spinning of cotton and in its various applications.

Dated 10th January, 1862.

80. W. Clark, 53, Chancery-lane—Imp. in apparatus for generating and applying steam as a motive power. (A com.)

Dated 11th January, 1862.

82. H. Charlton, Birmingham—Imp. in the manufacture of certain kinds of shoes for mules and horses.

Dated 13th January, 1862.

90. F. C. Warlich, 10, Alma-terrace, New Cross—Imp. in the manufacture of artificial fuel.

92. J. Parker, Ivy-house, Bradford, J. Wells and B. Wells, Bowling, near Bradford—Imp. in steam engines, boilers, furnaces, and apparatus in connection therewith or applicable thereto.

94. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of cups, bowls, saucers, and other dished articles and cases. (A com.)

96. G. Hewitt, Ipswich—Imp. in apparatus used in the manufacture of drain tiles.

100. C. N. May, Devizes—Imp. in the manufacture of pastry, and in apparatus for the same.

Dated 14th January, 1862.

106. W. Gorse, Minworth, Warwickshire—An imp. or imps. in machinery for manufacturing the cut nails called brads.

INVENTION WITH COMPLETE SPECIFICATION FILED.

162. W. Tozer, Gracechurch-street, and A. Read, Walworth—Imp in boots and shoes.—21st January, 1862.

PATENTS SEALED.

[*From Gazette, January 24th*, 1862.]

January 24th.

1877. W. Wigfall.
1885. J. Robertson.
1887. G. Sturrock.
1890. R. Riley.
1891. W. Melrose.
1892. C. C. J. Guffroy.
1893. W. L. Scott.
1897. T. Bradford.
1898. W. H. Ash.
1902. J. M. Hart.
1906. J. T. Flanders.
1914. E. J. Muygridge.
1927. G. F. Jones and J. Jones.
1931. J. Henderson and J. Broadley.
1963. E. T. Hughes.
1988. C. Lee and T. K. Mace.
1991. A. F. B. Falgas.
1992. G. H. Birkbeck.
2025. T. Silvester.
2758. B. Brown and R. Hacking.
2823. A. Turner.
2831. G. F. Wilson and G. Payne.

[*From Gazette, January 28th*, 1862.]

January 28th.

1912. H. Shaw.
1919. R. Benton.
1926. J. Cross.
1929. G. L. M. Viscount de Ponton d'Amécourt.
1933. J. Vavasseur.
1939. H. C. Meyer.
1941. E. D. Johnson.
1962. N. A. Lesueur.
1969. N. D. P. Maillard.
1973. W. S. Hogg.
1975. G. H. Bovill.
1979. H. Kinsey.
1983. J. Hemingway.
2001. A. Garzend.
2002. W. E. Gedge.
2039. J. Combe.
2076. G. F. Muntz.
2180. W. Fox.
2941. S. Sansum.
2953. J. Macintosh.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, January 24th*, 1862.]

January 20th.

193. J. Childs.
206. T. W. Rammell.
249. H. Rawson.
252. G. F. Bradbury and J. J. King.
291. M. Loam.

January 21st.

201. D. Moseley.
207. C. Sharps.
258. C. E. Amos and J. Francis.
265. J. Lane.
372. W. E. Newton.
443. H. Y. D. Scott.

[*From Gazette, January 28th*, 1862.]

January 23rd.

216. J. Fowler, jun., R. Burton, D. Greig, and J. Head.
238. D. Graham.
232. J. Kerr.
262. H. Watson.

January 24th.

222. H. Owen.
236. I. Hammond.

January 25th.

266. J. MacKenzie.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, January 24th*, 1862.]

January 20th.

301. G. F. Wilson and G. Payne.

[*From Gazette, January 28th*, 1862.]

23rd January.

181. C. W. Tupper.

25th January.

236. G. Price.